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A FOLLOW-UP STUDY ON D-VEND: AN AUTOMATED VENDING MACHINE FOR MEDICINES

ILUMINADA VIVIEN R. DOMINGO

Professor, Doctor in Business Administration, Polytechnic University of the Philippines, Manila, Philippines

ABSTRACT

The D-VEND is an automated vending machine for medicines. This study was conducted in 2015 by Domingo, et al to provide customers with over the counter drugs at their convenience using a mechanical device to supply the medicines. This is a follow-up study on the recommendations provided in that paper in 2015 by Domingo et al.

This study focused on how the costumers will have convenience in buying OTC medicines by implementing the use of a newer version applying all recommendations in the previous study. Based on the results of the implementation, the researchers concluded that for the clients, the machine is completely allotting the right medicine requested by the user. A part from this, it is also said to be capable of storing medicines safely with correct and updateable information. It is therefore considered reliable because it ensures the reliability of the medicines that it sells. Accuracy wise, the machine is correctly recognizing the coins inputted. The warning system still installed in the device gave the users the assurance that the medicines stored in the machine can be safely stored. It is therefore, suggesting that this machine can be very marketable in terms of customer and medicine security.

As this research has proved that there is a significant difference between the assessments of the students and the pharmacists. The proposed implementation to the general public was tested and proved to be worthy of its purpose. The larger population was used to test the accuracy and reliability of the vendor machine.

KEYWORDS: D-Vend, Machine, Vending Machine, Automation & Over-the-Counter Medicines

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Original Article

INTRODUCTION

Upon hearing the term ‘vending machine’, some are surprised to know that vending machines have originated in ancient Greece. (Barbacena 2017) The first known vending machine was invented by the Greek engineer and mathematician Hero of Alexandria around 215 BC. These first vending machines were located in Egyptian temples and dispensed holy water in exchange for coins. (Aban, 2015)

The following recommendations from the previous paper were added in the new version of D-vend namely:

- A touch screen interface was added.
- The machine can recognize different types of coins, and paper bills.
- D-vend machine gives monetary change for the convenience of the users.

- A more efficient database was added for the administrator part, and additional information important about the medicines.
- Users are able to buy different quantities of medicines upon his request.
- The machine is stand-alone and usable even without electricity.
- A less fragile container was installed providing more security of the medicines and the users of the machine. (Domingo, et.al. 2015)

RESEARCH PARADIGM

The researchers used the same top-level algorithm as shown below in Figure 1 as used in vending machines. The initial idea is that the users will be inputting coins, and then the machine will dispense the medicine it is set to dispense. (David 2016)

The programming language that was used in the study is also Microsoft Visual Studio or also known as C# for the interface of the system.

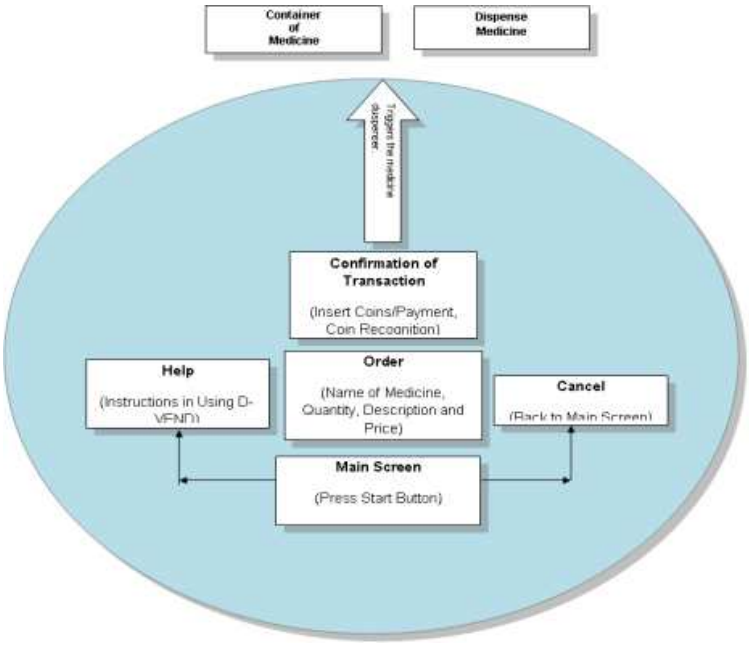

Figure 1

ANALYSIS AND INTERPRETATION OF DATA

The researchers randomly chose 500 respondents from the third year students from the College of Computer and Information Sciences and 50 experts, specifically pharmacists and pharmacy attendants, randomly chosen from different local drug stores within the vicinity of Sta. Mesa, Manila. The respondents' identities are not stated in this paper for privacy purposes. The same questionnaire from the previous paper was utilized to check for results if the same of there are also differences.

Table 1: Weighted Mean of the Assessment of Students with the Functionality of the System

Item	Weighted Mean	Verbal Interpretation
1. The machine dispenses the medicine that the customer wishes to buy	1.32	Very Good
2. The buttons of the machine quickly respond to the needs of the customer.	1.49	Very Good
3. The labels assigned to the buttons show the actual function stated.	1.29	Very Good
4. The machine correctly recognizes the number of coins inputted.	1.81	Very Good
5. The machine portrays the actual functions of a typical vending machine.	1.72	Very Good
6. the machine gives any monetary change	1.28	Very Good
Overall	**1.48**	**Very Good**

Table 2:Weighted Mean of the Assessment of Pharmacists with the Functionality of the System

Item	Weighted Mean	Verbal Interpretation
1. The machine dispenses the medicine that the customer wishes to buy.	1.75	Very Good
2. The buttons of the machine quickly responds to the needs of the customer.	1.35	Very Good
3. The labels assigned to the buttons show the actual function stated.	1.25	Very Good
4. The machine correctly recognizes the number of coins inputted.	1.50	Very Good
5. The machine portrays the actual functions of a typical vending machine.	1.35	Very Good
6. The machine gives any monetary change	1.63	Very Good
Overall	**1.74**	**Very Good**

Table 3:Weighted Mean of the Assessment of Students with the User-Friendliness of the System

Item	Weighted Mean	Verbal Interpretation
1. The machine is easy to use and to understand.	1.20	Very Good
2. The machine provides a user interface that is simple enough for the users to understand.	1.25	Very Good
3. The “Help” menu provided in the interface really helps the first-time buyers of D-VEND.	1.56	Very Good
4. The buttons are easy to press.	1.61	Very Good
5. The machine provides correct and up-to-date information about the medicines it sells.	1.72	Very Good
Overall	**1.223**	**Very Good**

Table 4: Weighted Mean of the Assessment of Pharmacists with the User-friendliness of the System

Item	Weighted Mean	Verbal Interpretation
1. The machine is easy to use and to understand.	2.25	Good
2. The machine provides a user interface that is simple enough for the users to understand.	2.75	Fair
3. The "Help" menu provided in the interface really helps the first-time buyers of D-VEND.	2.75	Fair
4. The buttons are easy to press.	3.25	Fair
5. The machine provides correct and up-to-date information about the medicines it sells.	3.13	Fair
Overall	**2.83**	**Fair**

Table 5:Weighted Mean of the Assessment of Students with the Reliability of the System

Item	Weighted Mean	Verbal Interpretation
1. The machine dispenses the right medicine the customer asks for.	1.45	Very Good
2. The machine dispenses the right amount of medicine that it is set to dispense.	1.85	Very Good
3. it provides accurate information about the medicines it sells.	1.75	Very Good
4. medicines are safely stored.	1.69	Very Good
Overall	**1.68**	**Very Good**

Table 6:Weighted Mean of the Assessment of Pharmacists with the Reliability of the System

Item	Weighted Mean	Verbal Interpretation
1. The machine dispenses the right medicine the customer asks for.	1.25	Very good
2. The machine dispenses the right amount of medicine that it is set to dispense.	1.88	Very good
3. it provides accurate information about the medicines it sells.	2.45	Good
4. medicines are safely stored	2.25	Fair
Overall	**1.95**	**Very good**

Table 7:Weighted Mean of the Assessment of Students with the Accuracy of the System

Item	Weighted Mean	Verbal Interpretation
1. The selected button responds correctly to the function assigned to it.	1.21	Very Good
2. The machine dispenses the right medicine the customer asks for.	1.29	Very Good
3. The machine correctly recognizes the coin/s inputted.	1.85	Very Good
4. The descriptions of medicines are correct.	1.80	Very Good
Overall	**1.53**	**Very Good**

Table 8:Weighted Mean of the Assessment of Pharmacists with the Accuracy of the System

Item	Weighted Mean	Verbal Interpretation
1. The selected button responds correctly to the function assigned to it.	2.75	Fair
2. The machine dispenses the right medicine the customer asks for.	2.66	Fair
3. The machine correctly recognizes the coin/s inputted.	3.45	Bad
4. The descriptions of medicines are correct.	3.54	Fair
Overall	**3.10**	**Fair**

Table 9:Weighted Mean of the Assessment of Students with the Security of the System

Item	Weighted Mean	Verbal Interpretation
1. The money inserted is stored in a safe place.	2.10	Good
2. Container does not have any sharp/edgy object that can hurt buyers.	2.05	Good
3. The machine has a warning system (that pre-empts the users when using), when the door is opened, or when the machine is being shaken	2.15	Good
4. The bought medicine is easy to get and does not require troublesome picking up.	1.95	Very Good
Overall	**2.05**	**Good**

Table 10: Weighted Mean of the Assessment of Pharmacists with the Security of the System

Item	Weighted Mean	Verbal Interpretation
1. The money inserted is stored in a safe place.	1.75	Very good
2. Container does not have any sharp/edgy object that can hurt buyers.	1.38	Very good
3. The machine has a warning system (that pre-empts the users when using), when the door is opened, or when the machine is being shaken	2.75	Fair
4. The bought medicine is easy to get and does not require troublesome picking up.	2.38	Fair
Overall	**2.06**	**Fair**

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Based on the results gathered from the students after the implementation, the researchers concluded that the students still agreed that the machine can be more functional and friendly for the users. (Ritz 2017)

A lot of them have similar opinions that the machine dispenses the right medicine that the users asked for and that the touch screen is easier to press and quickly responds to the users' needs. (Ro bVend 2016) It is functional because it performs the functions that it is set to perform. On the side of the pharmacists, the machine is now as good as it is perceived by the students. They have even given fair and very good verbal interpretations regarding the matter. The researchers therefore, conclude that there of no significant difference between their assessments. (Sanchez 2016)

Based on the results of the implementation, the researchers concluded that for the students, the machine is positively dispensing the right medicine requested by the user. (Lopez 2018) Apart from this, it is also said to be capable of storing medicines safely with correct and updateable information. It is therefore considered reliable because it ensures the reliability of the medicines that it sells. (Norhead 2017).

Accuracy wise, the machine is correctly recognizing the coins inputted. The warning system installed in the device gave the users the assurance that the medicines stored in the machine can be safely stored. It is therefore, suggesting that this machine can be very marketable in terms of customer and medicine security. (Merlin, 2017)

Likewise, as for the pharmacists' evaluation, the results are similar this time of writing. They recognized that the machine has a better screen because they can touch the commands already. (Musni 2016) It was able to dispense monetary change. Since this was made of a more physically secured material. There are more upgrades that should be added to the machine in order to ensure that it would be safe and its other features are more appropriate for users who are not so fond of technology. (Owen 2015)

RECOMMENDATION

As this research has proved that there is no significant difference between the assessments of the students and the pharmacists, a proposal for implementation to make D-vend a commercialized vendor machine would be very appropriate.

The study implemented larger sample size testing and that it requires further testing and application to a larger group of the general public in order to check the assessment of people in real time. This must require more implementation time to ensure that the results would be feasible.

The effectivity and efficiency of the system of the proposed system showed improvement over its first version. A test involving the actual users themselves should be conducted in order to obtain their perception with the use of an automated vending machine for medicines as opposed to the manual operations in buying medicines.

After this, a comparison between the proposed system and the previous (manual buying and selling of medicines) system would be very appropriate in order to really see if there is a significant difference between the two systems in order to finally conclude which would be better suited for real-time processes of buying and selling of medicines.

It is also recommended that to test the machine in a larger environment which includes investors like big pharmaceutical companies, the following questions should guide future researches:

- How did the machine affect the observations of the people who want to buy over the counter medicines?
- What are the effects of the implementation of the general wellness of the community?
- What is the success rate of the machine as opposed to the manual procedures in buying medicine?
- How did the general public accept the machine in terms of securing the vendor machine's safety from criminals?

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